ture and relative humidity data from privately owned instruments located within a few miles of the fire. From these record sheets a temperature of 84° F. and a dew point of 49° F. were deduced.

Example No. 5.—On December 31, 1917, another observation of cloud formation by a forest fire was made. In a photograph (fig. 4) made from the cooperative storm-warning display station of the Bureau on the shores of Santa Monica Bay, may be seen a cloud from a forest fire originating in the near-by Malibu Canyon. The tall column of smoke was carried horizontally northwestward under the influence of the light off-shore breeze. At an altitude of about 5,000 feet, condensation occurred over the upper surfaces of the smoke.

NOTE.

Some 20 years ago while I was stationed in Minneapolis a large lumber mill was destroyed by fire. The heat was intense and at an altitude of about 1,000 or 1,500 feet, I should judge, a cumulus cloud formed almost directly over the center of the fire. As I recollect, the general movement of the wind on that day was very slight, but the surface winds were quite fresh, blowing in toward the fire on all sides. This I know, because I went completely around the fire for the purpose of ascertaining if such was the case. . . .

The movement of the surface winds on all sides of the fire, in my opinion, is an important factor to be considered, especially in the case of very large fires such as have occurred in the North Pacific States, as well as in Minnesota, Michigan, and Canada. In looking over a Signal Service publication on the forest fires in Michigan, published many years ago, it was noted that the wind force close to the fire was reported to be very strong,[1] whereas the barometric gradients at that time indicated only light winds. I sometimes think that the winds engendered by fires of this character have a tendency to increase the area burned over, as well as the intensity of the fire, by thus supplying abundant oxygen to the burning pile. Of course, if the winds blew inward with equal force on all sides this would not occur, as after the inflammable materials were all consumed that would end the combustion; but if the pressure were greater on one side than on another, then the mass would progress and continue burning furiously so long as there was anything to burn.—*E. A. Beals, Section Director.*[2]

NOTES ON A CUMULUS CLOUD FORMED OVER A FIRE.

C. A. REICHELT, Assistant Observer.

[Dated: Weather Bureau, Honolulu, Hawaii, Dec. 10, 1918.]

An interesting form of the various cumulus clouds which occur almost daily in Hawaii is the small clouds that occasionally appear over the fires of the burning sugar-cane fields. These clouds have been seen near Honolulu several times and close observations were made of a typical specimen on September 27, 1918.

This cloud was observed from a train which passed around the fire and was about 2 miles distant from it. Observations and photographs were made at the stations where the train stopped and the time determined from the train schedule. The fire forming the cloud was from a cane field consisting of 35 acres and located on a narrow peninsula in Pearl Harbor, Oahu, and was about midway between the United States Weather Bureau at Honolulu and the United States Magnetic Observatory at Sisal, Oahu, and about 8 miles distant from each.

The fire began at 4:40 p. m. and a large column of smoke was immediately formed with a slight flattening at the top at a height of about 700 feet. As the fire made headway the smoke became more dense and kept rising and spreading out. The first roll of cumulus developed at the top of the column in about 10 minutes, and was well-marked by its white color, which contrasted strongly with the bronze black of the smoke. The cumulus rolls continued to form swiftly and at 4:57 p. m. (see fig. 1) when the fire was at its height the cloud had almost reached its final size, although the smoke, which was still very heavy, obscured it considerably. As the fire diminished the column of smoke from the earth gradually became less (see fig. 2), but the cloud continued to rise for a short distance, the base clearing somewhat and small rolls still forming at the apex. At 5:03 p. m., when the fire was practically out, the column of smoke from the earth had almost disappeared and a well-formed cumulus cloud was present. It was last seen at 5:15 p. m., or 20 minutes after it began to form, when the train passed out of the field of view.

An estimate of the height of the cloud and also of its size was formed by taking the altitude of the sun, which was observed through the edge of the cloud, and the horizontal distance of the base from the observer. At two different stations approximately the same results were obtained, which gave for the height of the base of the cloud about 1,500 feet and for the top about 2,500 feet, and for the width at the base about 1,000 feet. A comparison with the height of the 600-foot wireless aerial at the Pearl Harbor Naval Station gave a good check on these figures.

The approximate meteorological conditions under which the cloud was formed can be obtained from an average of the records of the United States Weather Bureau and the United States Magnetic Observatory, both of which are official records. The temperature at the Weather Bureau Office, 8 miles to the east, at 4:30 p. m., or just preceeding the fire, was 79°; at the Magnetic Observatory, 8 miles to the west, it was 84°, giving a mean temperature of 82°. The dew point and the relative humidity at both stations were the same, being 68 and 71 per cent, respectively. The direction of the wind was from the south, with a velocity of 8 miles per hour at Honolulu.*

As previously mentioned, these clouds have been observed frequently at Honolulu and they have been seen at all seasons of the year. They are usually formed in the early morning or late afternoon hours and have never been observed forming in the middle of the day. They are best formed under conditions of calm or very light winds, occur over fires of all sizes, and have been known to form over large smokestacks on very still days. They are apparently true cumulus and have the same color, shape, and appearance as other cumulus clouds in Hawaii. Also they do not dissipate rapidly as would be the case with smoke clouds. In the present instance the cloud was only seen for a relatively short time, but in June, 1917, a cloud of much greater size, formed at 8 a. m., was still visible two hours later. No instances have ever been recorded in these islands of these clouds producing precipitation.

[1] The same was decidedly the case in the Minnesota fires of mid-October, 1918, as mentioned in the MONTHLY WEATHER REVIEW, November, 1918, 46: 506-509, and as described in detail by H. W. Richardson in the Geographical Review, April, 1919, 7: 220-232, 5 figs.—EDITOR.

[2] See also "Meteorological observations during the burning of the plant of the Standard Oil Company at Bayonne, N. J., July 5, 6, and 7, 1900," by W. H. Mitchell (Mo. Wea. Rev., 1900, 28: 325-326.)—EDITOR.

* See discussion on p. 149 of this issue of the REVIEW.

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FIG. 2.—Cloud-capped smoke column above Cucumonga Canyon, Calif. The smoke from a chapparal fire along the base of the Sierra Madre Mountains in southern California which terminated in a cumulo-nimbus cloud. Scarf clouds may be seen at the apex of the cloud mass. [Photographed by T. R. Trowbridge.]

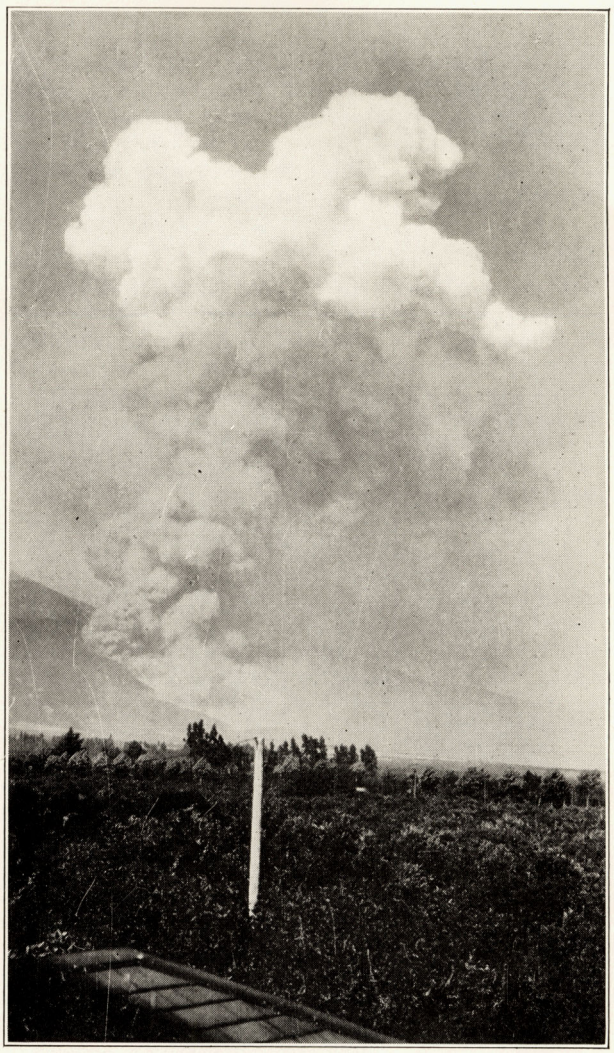

FIG. 3.—Later photograph of cloud-capped smoke column in Cucumonga Canyon. This second photograph was made about 30 minutes after the previous one was taken and shows the disappearance of the "false cirrus" cloud. This photograph represents the maximum mushroom phase, as further observation of the progress of the terminating cloud showed it did not spread out as in previous instances of like formation. [Photographed by T. R. Trowbridge.]

FIG. 4.—Smoke column in Malibu Canyon, Santa Monica Mountains. This photograph was made from the Weather Bureau storm-warning display station on the shores of Santa Monica Bay, and shows a forest fire in the Malibu Canyon. The tall column of smoke was carried horizontally northwestward under the influence of the light offshore breeze. At an altitude of about 5,000 feet condensation occurred over the upper surfaces of the smoke. [Photographed by A. Deraga.]

[To face p. 144.]

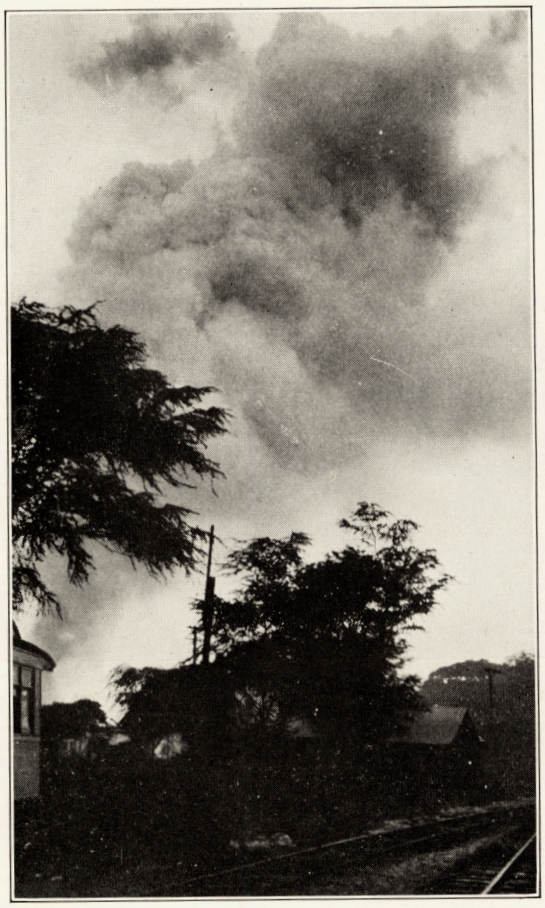

FIG. 1.—4:57 p. m., cumulus cloud formed, but considerable smoke still present.

FIG. 2.—5 p. m., cumulus well formed, fire dying out.